# THE JOURNAL OF HORTICULTURAL SCIENCE

#### **BOARD OF EDITORS**

#### **Editor:**

A R REES, BSc, DSc, CBiol, FIBiol, Journal of Horticultural Science, PO Box 3015, Littlehampton, West Sussex BN16 3SX, UK.

#### Associate Editors:

J G ATHERTON, BSc, PhD, University of Nottingham, Sutton Bonington, Leicestershire LE12 5RD.

W R AUTIO, BS, MS, PhD, Department of Plant & Soil Science, University of Massachusetts, Amherst, MA 01003-0910, USA.

R M BRENNAN, BSc, PhD, Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA.

J G BUWALDA, BAgrSc, PhD, The Horticulture and Food Research Station of NZ Ltd, Private Bag 3123, Hamilton, New Zealand.

T CARUSO, Università degli Studi di Palermo, Istituto di Coltivazioni Arboree, Viale delle Scienze 11, 90128 Palermo, Italy.

J M DUNCAN, BSc, PhD, Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA. R FORDHAM, BSc, PhD, Wye College, Nr Ashford, Kent TN25 5AH.

G R HANKS, BSc, MPhil, MIHort, CBiol, MIBiol, Horticulture Research International, Kirton, Boston, Lincolnshire PE20 1NN.

G V HOAD, BSc, PhD, CBiol, FIBiol, Department of Biology, University of Bahrain, College of Science, P.O. Box 32038, State of Bahrain.

B H HOWARD, BSc, PhD, Horticulture Research International, East Malling, Maidstone,

Kent ME19 6BJ. P JOHN, BSc, PhD, Department of Agricultural Botany, University of Reading, Reading

RG6 2AS. P J LUMSDEN, BSc, PhD, University of Central Lancashire, Preston PR1 2HE.

D K L MACKERRON, BSc, PhD, Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA.

S H MANTELL, BSc, MSc, DIC, DTA, PhD, Wye College, Nr Ashford, Kent TN25 5AH.

J D QUINLAN, BSc, PhD, Horticulture Research International, East Malling, Maidstone, Kent ME19 6BJ.

T J RIGGS, BSc, PhD, Horticulture Research International, Wellesbourne, Warwick CV35 9EF.

W W Schwabe, DIC, PhD, DSc, DAghc(As), FIBiol, FIHort, FLS, Wye College, Nr Ashford, Kent TN25 5AH.

H WAINWRIGHT, BSc, PhD, Writtle College, Chelmsford, Essex CM1 3RR.

R R WALKER, BAgrSc, PhD, CSIRO Division of Horticulture, Merbein, Victoria 3305, Australia.

S J WERTHEIM, Dr Ir, Proefstation voor de Fruitteelt, Brugstraat 51, 4475 An Wilhelminadorp, The Netherlands.

D C E WURR, MA, PhD, Horticulture Research International, Wellesbourne, Warwick CV35 9EF.

#### BOARD OF TRUSTEES

W W Schwabe, DIC, PhD, DSc, DAghc(As), FIBiol, FIHort, FLS (Chairman) P G ALDERSON, BSc, PhD, MIHort D F DAY, BSc, CBiol, FIBiol, FIHort

G R DIXON, BSc, PhD, FIHort, CBiol, FIBiol

G G HENSHAW, BSc, PhD

J R HILLMAN, BSc, PhD, FLS, CBiol, FIBiol, FRSE

J MOORBY, BSc, PhD, FIHort

C C PAYNE, MA, DPhil, CBiol, MIBiol, FIHort

H D TINDALL, MBE, BSc, MSc, MHort, FLS, CBiol, FIBiol, FIHort

H F VAN EMDEN, BSc, ARCS, PhD, DIC, FRES

D J RIGDEN (Headley Brothers Ltd)

A R REES, BSc, DSc, CBiol, FIBiol (Editor)

D M HART (Secretary/Treasurer) R L Oxley, MMIB (Investment Manager)

VOL. 70 1995

**HEADLEY BROTHERS LTD** The Invicta Press, Ashford, Kent England

PRINTED IN GREAT BRITAIN BY HEADLEY BROTHERS LTD INVICTA PRESS ASHFORD KENT AND LONDON

### TABLE OF CONTENTS

## THE JOURNAL OF HORTICULTURAL SCIENCE, VOL. 70

NO.1 (JANUARY 1995)

P. LACHENAUD: Variations in the number of beans per pod in <i>Theobroma cacao</i> L. in the Ivory Coast. II. Pollen germination, fruit setting and ovule development	1–6
P. LACHENAUD: Idem. III. Nutrition factors, cropping effects and the role of boron	7–13
D. J. ROE, J. H. OOSTHUIZEN and C. M. MENZEL: Rate of soil drying and previous water deficits influence the relationship between CO <sub>2</sub> assimilation and tree water status in potted lychee ( <i>Litchi chinensis Sonn.</i> )	
J. E. DRINNAN and C. M. MENZEL: Temperature affects vegetative growth and flowering of cofee ( <i>Coffea arabica</i> L.)	15-24
L. Burgos, T. Berenguer and J. Egea: Embryo-sac development in pollinated and non-pollinated flowers of two apricot cultivars	25–34 35–39
R. FERNANDEZ-MUÑOZ, J. J. GONZALEZ-FERNANDEZ and J. CUARTERO: Variability of pollen tolerance to low temperatures in tomato and related	33-39
Wild species	41–49
on banana ripening	51–55
O. K. YAMANISHI: Trunk strangulation and winter heating effects on fruit size,	57–64
internal quality and maturation of 'Tosa Buntan' pummelo grown in a plastic house	65–74
S. O. GRIMSTAD: Low-temperature pulse affects growth and development of young cucumber and tomato plants	75–80
acetaldehyde and ethyl formate vapour on the growth of <i>Penicillium italicum</i> and <i>P. digitatum</i> on oranges	81–84
O. K. Yamanishi: Trunk strangulation and winter heating effects on carbohydrate level and its relation with flowering, fruiting and yield of 'Tosa Buntan' pummelo grown in a plastic house	85–95
CARMEN MARTÍN and C. PÉREZ: Micropropagation of five endemic species of Limonium from the Iberian peninsula	97–103
K. DIMASSI-THERIOU: In vitro rooting of rootstock GF-677 (Prunus amygdalus x P. persica) as influenced by mineral concentration of the nutrient medium and type of culture-tube sealing material	105–108
J. P. CHELLEW and C. R. LITTLE: Alternative methods of scald control in 'Granny Smith' apples	109–115
Z. N. Deng, A. Gentile, E. Nicolosi, F. Domina, A. Vardi and E. Tribulato: Identification of <i>in vivo</i> and <i>in vitro</i> lemon mutants by RAPD markers	117–125
E. W. PAVEL and T. M. DEJONG: Seasonal patterns of nonstructural carbohydrates of apple ( <i>Malus pumila Mill.</i> ) fruits: Relationship with relative growth rates and contribution to solute potential	127–134
G. Booy: Identification of gerbera cultivars based on differences in phenolic compounds in ray florets	135–146
K. Eckstein and J. C. Robinson: Physiological responses of banana ( <i>Musa</i> AAA; Cavendish sub-group) in the subtropics. I. Influence of internal plant factors	147 156
on gas exchange of banana leaves	147–156 157–167
K. Eckstein, J. C. Robinson and S. J. Davie: <i>Idem</i> . III. Gas exchange, growth analysis and source-sink interaction over a complete crop cycle	169–180

FORTHCOMING PAPERS

S. PEARSON, ANN PARKER, S. R. ADAMS, P. HADLEY and D. R. MAY: The effects of temperature on the flower size of pansy ( <i>Viola x wittrockiana</i> Gams.)	183–190
JF. GONNET: A colorimetric look at the RHS Chart – Perspectives for an instrumental determination of colour codes	191–206
G. WADASINGHE and C. S. Hew: The importance of back shoots as a source of photoassimilates for growth and flower production in <i>Dendrobium</i> cv.	207–214
B. Aloni, Leah Karni and Irena Rylski: Inhibition of heat induced pepper	207-214
(Capsicum annuum) flower abscission and induction of fruit malformation by silver thiosulphate	215–220
R. SCIUTTI AND S. MORINI: Water loss and photosynthesis of plum plantlets is influenced by relative humidity during rooting <i>in vitro</i>	221–228
M. MAESTRI, F. M. DA MATTA, A. J. REGAZZI and R. S. BARROS: Accumulation of proline and quaternary ammonium compounds in mature leaves of water stressed coffee plants ( <i>Coffea arabica</i> and <i>C. canephora</i> )	229–233
K. H. Higgs, N. A. Hipps and L. G. Collard: Effects of irrigation and nitrogen fertilization on the water relations of <i>Prunus avium</i> and 'Colt' ( <i>P. avium</i> L. x	
P. pseudocerasus Lind.) in the nursery, and residual effects after outplanting  C. M. MENZEL, T. S. RASMUSSEN and D. R. SIMPSON: Carbohydrate reserves in	235–243
lychee trees ( <i>Litchi chinensis</i> Sonn.)	245–255
and fruiting of glasshouse strawberry	257–262
S. SIDDIQUI and F. BANGERTH: Effect of pre-harvest application of calcium on flesh firmness and cell-wall composition of apples—influence of fruit size	263–269
ZORA SINGH and LAKHVIR SINGH: Increased fruit set and retention in mango with exogenous application of polyamines	271–277
W. LETCHAMO and A. GOSSELIN: Root and shoot growth and chlorophyll content of <i>Taraxacum officinale</i> provenances as affected by defoliation and	
debudding under organic and hydroponic cultivation	279–285
Benzyladenine and carbaryl effects on fruit thinning and the enhancement of return flowering of three apple cultivars	287–296
M. V. GONZALEZ, M. A. LAGE and P. PASEIRO: Time-dependence of physico chemical characteristics of kiwifruit between fruitset and harvest in Galicia	
(N. W. Spain)	297–301
S. KUMAR, V. P. SHARMA and H. C. KAPOOR: Isozymic identification of cultivars of ber ( <i>Zizyphus mauritania</i> Lamk.)	303–306
C. Magne and F. Larher: Changes in ethylene-producing capacity of apple fruit tissues during natural or induced senescence	307–314
W. L. CASALE, V. MINASSIAN, J. A. MENGE, CAROL J. LOVATT, ELINOR POND, E. JOHNSON AND F. GUILLEMET: Urban and agricultural wastes for use as mulches on avocado and citrus and for delivery of microbial biocontrol	
agents	315–332
G. Booy: Identification of gerbera cultivars based on differences in phenolic compounds in ray florets	125 140
G. J. KING: Morphological development in <i>Brassica oleracea</i> is modulated by	135–146
in vivo treatment with 5-azacytidine	333–342
G. R. HANKS: Prevention of hot-water treatment damage in narcissus bulbs by	
pre-warming	343–355

A. J. KRAJEWSKI and E. RABE: Review Article: Citrus flowering: A critical	
evaluation	357–374
M. C. GOFFINET, T. L. ROBINSON and A. N. LAKSO: A comparison of 'Empire' apple fruit size and anatomy in unthinned and hand-thinned trees	375–387
A. N. Lakso, L. Corelli Grappadelli, J. Barnard and M. C. Goffinet: An expolinear model of the growth pattern of the apple fruit	389–394
K. E. COCKSHULL and L. C. Ho: Regulation of tomato fruit size by plant density and truss thinning	395–407
F. Mencarelli, R. Agostini, R. Botondi and R. Massantini: Ethylene production, ACC content, PAL and POD activities in excised sections of straight and bent gerbera scapes	409-416
Annarita Leva, R. Muleo and Raffaella Petrucelli: Long-term somatic embryogenesis from immature olive cotyledons	417–421
R. ROMERA-ARANDA and J. J. LONGUENESSE: Modelling the effect of air vapour pressure deficit on leaf photosynthesis of greenhouse tomatoes: The	
importance of leaf conductance to CO <sub>2</sub>	423–432
J. Costa, M. Bosch and A. Blanco: Growth and cropping of 'Blanquilla' pear trees treated with paclobutrazol	433-443
A. J. Krajewski and E. Rabe: Effect of heading and its timing on flowering and vegetative shoot development in Clementine mandarin ( <i>Citrus reticulata</i>	
Blanco)	445–451
G. O. NKANSAH and T. ITO: Comparison of mineral absorption and nutrient composition of heat-tolerant and non heat-tolerant tomato plants at different	150 160
root-zone temperatures	453–460
E. O. OWUSU, CS. KIM, M. HORIIKE and C. HIRANO: Some dichlorvos induced plant enzymes and their possible influence on field control of cotton aphid (Homoptera: Aphididae)	461–467
KSHANIKA HIRUMBUREGAMA AND NIRANJINI GAMAGE: Propagation of Bambusa vulgaris (yellow bamboo) through nodal bud culture	469–475
A. P. GEORGE, R. J. NISSEN, R. J. COLLINS and T. S. RASMUSSEN: Effects of fruit thinning, pollination and paclobutrazol on fruit set and size of persimmon	and which
(Diospyros kaki L.) in subtropical Australia	477-484
P. E. RAJASEKHARAN, S. GANESHAN and V. THAMIZHARASU: Expression of trifoliate leaf character in <i>Citrus limonia x Poncirus trifoliata</i> hybrids through	
cryostored pollen	485–490
A. G. ALI and CAROL J. LOVATT: Relationship of polyamines to low-temperature stress-induced flowering of the 'Washington' navel orange ( <i>Citrus sinensis</i> L.	404 400
Osbeck)	491–498
R. A. E. TILNEY-BASSETT, A. A. MUNSHI, A. B. ALMOUSLEM and N. S. NASSER: The inheritance of red, salmon, rose-pink and soft-pink flower colours in zonal pelargoniums	499–508
M. Boselli, B. Volpe and C. Di Vaio: Effect of seed number per berry on	477 300
mineral composition of grapevine (Vitus vinifera L.) berries	509–515
D. Gray, Joyce R. A. Steckel, S. Miles, J. Reed and R. W. P. Hiron: Improving seedling establishment by a dibber drill	517–528
	PERSONAL RE
FORTHCOMING PAPERS	529

J. G. BUWALDA and F. LENZ: Water use by European pear trees growing in drainage lysimeters	531–540
D. S. JOHNSON: Effect of flower and fruit thinning on the maturity of 'Cox's Orange Pippin' apples at harvest	541–548
K. Eckstein and J. C. Robinson: Physiological responses of banana ( <i>Musa</i> AAA; Cavendish sub-group) in the subtropics. IV. Comparison between tissue culture and conventional planting material during the first months of development	549–559
P. K. Andrews and Shulin Li: Cell wall hydrolytic enzyme activity during development of nonclimacteric sweet cherry ( <i>Prunus avium</i> L.) fruit	561–567
D. K. PAL and P. SAMPATH KUMAR: Changes in the physico-chemical and biochemical composition of custard apple ( <i>Annona squamosa</i> L.) fruits during growth, development and ripening	569–572
H. E. POCASANGRE ENAMORADO, F. L. FINGER, R. S. BARROS and P. PUSCHMANN:  Development and ripening of yellow passion fruit	573–576
D. K. ADITYA and R. FORDHAM: Effects of cold treatment and of gibberellic acid on flowering of cauliflower	577–585
J. STOW: The effects of storage atmosphere on the keeping quality of 'Idared' apples	587–595
J. A. Franco, J. M. Abrisqueta and A. Hernansaez: Root development of almond rootstocks in a young almond orchard under trickle irrigation as affected by almond scion cultivars	507 605
R. ALIQUE: Residual effects of short-term treatments with high CO <sub>2</sub> on the ripening of cherimoya ( <i>Annona cherimola</i> Mill.) fruit	597–607
M. AZNAR, V. ALMELA, M. JUAN, M. EL-OTMANI and M. AGUSTI: Effect of the synthetic auxin phenothiol on fruit development of 'Fortune' mandarin	617–621
A. Blanco, A. Pequerul, J. Val, E. Monge and J. Gomez Aparisi: Crop-load effects on vegetative growth, mineral nutrient concentration and leaf water potential in 'Catherine' peach	
L. Sekse: Cuticular fracturing in fruits of sweet cherry ( <i>Prunus avium</i> L.) resulting from changing soil water contents	623–629 631–635
BEATE RAMSTAD, A. T. PEDERSEN and Ø. M. ANDERSEN: Delphinidin 3-α-arabinopyranoside and other anthocyanins from flowers of <i>Rhododendron</i> cv.	031-033
Lems Stormcloud	637–642
H. AGBARIA, BRURIA HEUER and N. ZIESLIN: Effects of grafting on transpiration, CO <sub>2</sub> fixation and growth of rose plants ( <i>Rosa</i> x hybrida cvs Ilseta and	643–650
Mercedes)	651–656
methanethiol emission from anaerobic broccoli florets	657–663
W. G. PILL, H. D. TILMON and R. W. TAYLOR: Nitrogen-enriched ground kenaf	665–672
(Hibiscus cannabinus L.) stem core as a component of soilless growth media FEDERICA ROSSI, F. NEROZZI, O. FACINI and T. GEORGIADIS: Determination of peach leaf area index by radiation measurements	673–681
FORTHCOMING PAPERS	683–689

vii

691-703

705-711

713-719

721-736

737-747

749-756

787-797

799-806

807-816

817-825

827-831

833-840

841-846

847-854

855

H. G. McPherson, C. JILL STANLEY and I. J. WARRINGTON: The response of bud break and flowering to cool winter temperatures in kiwifruit (Actinidia deliciosa) .. .. .. .. .. .. .. .. .. .. C. JILL STANLEY, H. G. McPherson and Julie A. Plummer: The use of unrooted

cuttings for studying the effects of chilling in kiwifruit (Actinidia deliciosa) ...

C. S. HEW, S. E. HIN, J. W. H. YONG, S. S. GOUK and M. TANAKA: In vitro CO2 enrichment of CAM orchid plantlets .. .. .. .. .. .. .. ..

L.) stem core

C. M. MENZEL, G. F. HAYDON and D. R. SIMPSON: Growth of lychee (Litchi chinensis Sonn.) in sand culture under variable nitrogen supply .. .. .. 757-767

GAYNOR R. RICHARDSON and A. K. COWAN: Abscisic acid content of Citrus flavedo in relation to colour development .. .. .. .. .. .. .. .. 769-773 B. H. HOWARD: Opportunities for developing clonal rootstocks from natural

775-786 ANGELA M. SNOWBALL: The seasonal cycle of leaf, shoot and bud development in

I. HORAN, S. WALKER, A. V. ROBERTS, J. MOTTLEY and I. SIMPKINS: Micropropagation of roses: The benefits of pruned mother-plantlets at Stage II and a greenhouse environment at Stage III .. .. .. .. ..

A. P. GEORGE, R. J. NISSEN, R. J. COLLINS and G. F. HAYDON: Seasonal leaf nutrient patterns and standard leaf nutrient levels for non-astringent persimmon in subtropical Australia .. .. .. .. .. .. .. .. .. .. ..

A. GARCIA-LUIS, M. KANDUSER and J. L. GUARDIOLA: The influence of fruiting on the bud sprouting and flower induction responses to chilling in Citrus ... S. KETSA and S. PANGKOOL: The effect of temperature and humidity on the

W. G. PILL, BING SHI, H. D. TILMON and R. W. TAYLOR: Leaching losses and plant uptake of nitrogen in soilless media containing ground kenaf (Hibiscus cannabinus L.) stem core .. .. .. .. .. .. .. .. .. .. ..

J. CARREÑO, L. ALMELA, A. MARTÍNEZ and J. A. FERNÁNDEZ-LÓPEZ: Colour changes associated with maturation of the table grape cv. Don Mariano ...

W. C. OLIEN, R. W. MILLER, JR., C. J. GRAHAM, E. R. TAYLOR, JR. and M. E. HARDIN: Effects of combined applications of ammonium thiosulphate and fungicides on fruit load and blossom blight and their phytoxicity to peach trees

FORTHCOMING PAPERS ...

T. CARUSO, A. FABBRI and D. GIOVANNINI: Inflorescence bud growth, development and abscission in shoots of bearing and disbudded 'Bianca' pistachio trees	857–866
A. ITAI, K. TANABE, F. TAMURA, S. SUZAKI, Y. YONEMORI and A. SUGIURA:  Synthetic cytokinins control persimmon fruit shape, size and quality	867–873
O. K. Yamanishi and K. Hasegawa: Trunk strangulation responses to the detrimental effect of heavy shade on fruit size and quality of 'Tosa Buntan'	
pummelo	875–887
S. N. VEMMOS: Carbohydrate changes in flowers, leaves, shoots and spurs of 'Cox's Orange Pippin' apple during flowering and fruit setting periods	889–900
A. ROSU, R. M. SKIRVIN, A. BEIN, M. A. NORTON, M. KUSHAD and A. G. OTTERBACHER: The development of putative adventitious shoots from a	
chimeral thornless rose (Rosa multiflora Thunb. ex J. Murr.) in vitro	901–907
L. C. Ho, P. Adams, X. Z. Li, H. Shen, J. Andrews and Z. H. Xu: Responses of Ca-efficient and Ca-inefficient tomato cultivars to salinity in plant growth,	enneggiant g
calcium accumulation and blossom-end rot	909–918
E. E. Protopapadakis: Genetic analysis of glutamate oxaloacetate transaminase from leaves of Cretan tulip species	919–923
P. GARCIA, M. BRENES, C. ROMERO and A. GARRIDO: Respiration and	nigrally.
physicochemical changes in harvested olive fruits	925–933
PATRICIA S. WAGENMAKERS and O. CALLESEN: Light distribution in apple orchard systems in relation to production and fruit quality	935–948
S. SIDDIQUI and F. BANGERTH: Differential effects of calcium and strontium on flesh firmness and properties of cell walls in apples	949–953
M. AGUSTI, M. EL-OTMANI, M. AZNAR, M. JUAN and V. ALMELA: Effect of 3, 5, 6-trichloro-2-pyridyloxyacetic acid on clementine early fruitlet development	ngeralit
and on fruit size at maturity	955-962
J. F. SMITH and MARGARET LOVE: Investigations into the cultural requirements of a brown capped <i>Agaricus</i> strain (W4 II) isolated from <i>Cupressus</i> leaf litter	963–974
V. CHOULIARIS, D. GERASOPOULOS and S. LIONAKIS: The effect of summer	LADRAG S
pruning and shading on the yield and quality of 'Hayward' kiwifruit	975–980
C. M. MENZEL and D. R. SIMPSON: Temperatures above 20°C reduce flowering in lychee ( <i>Litchi chinensis</i> Sonn.)	981–987
B. H. HOWARD and R. S. HARRISON-MURRAY: Responses of dark-preconditioned and normal light-grown cuttings of <i>Syringa vulgaris</i> 'Madame Lemoine' to	701-707
light and wetness gradients in the propagation environment	989–1001
FORTHCOMING PAPERS	DEMMANY A
TORTHOUGHTO LAIDRO	1003